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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/556,063

03/09/2007

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136081

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25944 7590 06/10/2009
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EXAMINER

BOURKE, ALLISON

ART UNIT

PAPER NUMBER

4133

MAIL DATE

DELIVERY MODE

06/10/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/556,063	Applicant(s) TAKAHASHI ET AL.	
	Examiner Allison Bourke	Art Unit 4133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 April 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) 14-23 and 27-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 24-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>1/28/2009, 3/9/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Invention I, claims 1-13 and 24-26, in the reply filed on March 16, 2009 is acknowledged. The traversal is on the ground(s) that all claims corresponding to the same single general inventive concept the catalytic CVD process, as noted on page 2 of the restriction requirement. This is not found persuasive because page 2 of the restriction requirement does not state that all claims correspond to the same single general inventive concept. In fact, page 2 of the restriction requirement states the inventions of Groups I and II are not so linked as to form a single general inventive concept under PCT Rule 13.1 because the special technical feature of group 2 is film deposited by catalytic CVD process, and this special feature is not included in group 1 which is directed to a product.

Further the applicant argues that the fact that independent claims 1, 9, and 13 are drawn to solar cell product and independent claims 14, 17, and 22 are drawn to a method of manufacturing the solar cell product is not proper grounds for restriction. This is not found persuasive because as stated on page 2 of the restriction requirement, the restriction is required because the inventions of Groups I and II are not so linked as to form a single general inventive concept under PCT Rule 13.1 because the special technical feature of group 2 is film deposited by catalytic CVD process, and this special feature is not included in group 1 which is directed to a product.

Further, the applicant argues the claims meet the unity of invention requirement because, as recited in 37 C.F.R. § 1.475(b), "a national stage application containing

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claims to different categories of invention will be considered to have unity of invention if the claims are drawn [to]... (1) A product and a process specially adapted for the manufacture of said product." This is not found persuasive because MPEP 1850 (III) A states: "The method for determining unity of invention under PCT Rule 13 shall be construed as permitting, in particular, the inclusion of any one of the following combinations of claims of different categories in the same international application: (A) In addition to an independent claim for a given product, an independent claim for a process specially adapted for the manufacture of the said product, and an independent claim for a use of the said product;.."

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 14-23 and 27-30 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on April 2, 2009.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-5, 8 and 10-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "principally" in claims 1 and 2 is a relative term which renders the claim indefinite. The term "principally " is not defined by the claim, the specification does not

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provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. This is because it is not clear how the inorganic insulating film can be principally silicon, and can include the range $Si/N < 1$ as recited in claim 6. For examination purposes, claims 1 and 2 are interpreted to include the range as recited in claim 6.

Claim 8 recites the limitation "the back-side insulating film" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 4-7, 10-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Chauduri (WO 89/00341).

Regarding claims 1, 5-6, 10 and 12 Chauduri discloses a solar cell comprising

- a semiconductor solar cell substrate (2) having a light receiving surface (PG6/L13-14, "front side") formed on a first major surface (Fig) thereof, and generating photovoltaic power based on the light irradiated on the light receiving surface (P1/L1-4), wherein
- the light receiving surface (PG6/L13-14, "front side") of the semiconductor solar cell substrate (2) is covered with a light-receiving-surface-side insulating film (10) provided as an inorganic insulating film (inherent of silicon nitride films)

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composed of an inorganic insulating material having a cationic component (inherent of silicon nitride films) thereof principally comprising silicon (PG8/L17-22), and the light-receiving-surface- side insulating film is configured as a low-hydrogen-content inorganic insulating film having a hydrogen content of less than 10 at% (PG8/L26-27: $\text{Si}_x\text{H}_y\text{N}_z$ and x and z each range from about 1.0 to 1.3 resulting in Si/N is between 0.769 and 1.3, y ranges from about 0.05 to 0.30 resulting in hydrogen content ranging from 1.9% to 15%)

- the low-hydrogen-content inorganic insulating film is a silicon nitride film formed so as to adjust the Si/N atomic ratio thereof to 0.80 to 1.80 (PG8/L17-22: $\text{Si}_x\text{H}_y\text{N}_z$ and x and z each range from about 1.0 to 1.3 resulting in Si/N is between 0.769 and 1.3), both ends inclusive

Regarding limitations recited in claims 5, 10, and 12 which are directed to method of making said inorganic insulating film, it is noted that said limitations are not given patentable weight in the product claims. Even though a product-by-process is defined by the process steps by which the product is made, determination of patentability is based on the product itself and does not depend on its method of production. *In re Thorpe*, 777 F.2d 695, 227 USPQ 964 (Fed. Cir. 1985). As the court stated in *Thorpe*, 777 F.2d at 697, 227 USPQ at 966 (The patentability of a product does not depend on its method of production. *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969). If the product in a product-by-process claim is the same or obvious as the product of the prior art, the claim is unpatentable even though the prior art product

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was made by a different process.). See MPEP 2113 and 2114. *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983).

Regarding claims 4, 7, 11, Chauduri discloses all the claim limitations as set forth above and further discloses the solar cell wherein

- the light-receiving-surface-side insulating film is configured as the low-hydrogen-content inorganic insulating film composed of silicon nitride having a refractive index of 2 to 2.5 (PG13/L29-31), both ends inclusive.
- the silicon nitride film has a refractive index of 2 to 2.5, both ends inclusive (PG13/L29-31).
- the semiconductor solar cell substrate is a silicon substrate (abstract), the inorganic insulating film is a silicon nitride film (PG8/L17-19), and the surface-treatment gas is ammonia gas (PG8/L9-12).

7. Claims 1, 4-7 and 10-12 are rejected under 35 U.S.C. 102(a) as being anticipated by Holt et al. (*Hot-wire chemical vapor deposition of high hydrogen content silicon nitride for solar cell passivation and anti-reflection coating applications*).

Regarding claims 1, 5-6, 10 and 12 Holt discloses a solar cell (S3.4) comprising

- a semiconductor solar cell substrate (String Ribbon silicon substrates, S3.4) having a light receiving surface formed on a first major surface (inherent to all solar cells: front surface for light receiving) thereof, and generating photovoltaic power based on the light irradiated on the light receiving surface (S3.4), wherein
- the light receiving surface of the semiconductor solar cell substrate is covered with a light-receiving-surface-side insulating film (abstract: SiN, S3.4: nitride)

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provided as an inorganic insulating film (inherent of SiN films) composed of an inorganic insulating material having a cationic component (inherent of SiN films) thereof principally comprising silicon (Table 1: Si/N ratio and S3.1), and the light-receiving-surface-side insulating film is configured as a low-hydrogen-content inorganic insulating film having a hydrogen content of less than 10 at% (Table 1: [H] and Conclusions).

- the low-hydrogen-content inorganic insulating film is a silicon nitride film (abstract) formed so as to adjust the Si/N atomic ratio thereof to 0.80 to 1.80 (Table 1), both ends inclusive.

Regarding limitations recited in claims 5, 10 and 12 which are directed to method of making said inorganic insulating film, it is noted that said limitations are not given patentable weight in the product claims. Even though a product-by-process is defined by the process steps by which the product is made, determination of patentability is based on the product itself and does not depend on its method of production. *In re Thorpe*, 777 F.2d 695, 227 USPQ 964 (Fed. Cir. 1985). As the court stated in Thorpe, 777 F.2d at 697, 227 USPQ at 966 (The patentability of a product does not depend on its method of production. *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969). If the product in a product-by-process claim is the same or obvious as the product of the prior art, the claim is unpatentable even though the prior art product was made by a different process.). See MPEP 2113 and 2114. *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983).

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Regarding claims 4, 7, and 11 Holt discloses all the claim limitations as set forth above and further discloses a solar cell wherein

- the light-receiving-surface-side insulating film is configured as the low-hydrogen-content inorganic insulating film composed of silicon nitride having a refractive index of 2 to 2.5 (S1/L1-3), both ends inclusive.
- the silicon nitride film has a refractive index of 2 to 2.5 (S1/L1-3), both ends inclusive
- the semiconductor solar cell substrate is a silicon substrate (S2/P4), the inorganic insulating film is a silicon nitride film (abstract), and the surface-treatment gas is ammonia gas (S2/P1).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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10. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claims 2-3, 8-9, 13, 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chauduri (WO 89/00341) as applied to claims 1, 4-7, 10-12 above, in view of Münzer (2005/0016585).

Regarding claims 2 and 8 Chauduri discloses all the claim limitations as set forth above and further discloses a solar cell wherein a second major surface of the semiconductor solar cell substrate (PG6/L17-19, "rear side"). While Chauduri discloses insulating film (10), provided as an inorganic insulating film (inherent of SiN films) composed of an inorganic insulating material having a cationic component (inherent of SiN films) thereof principally comprising silicon (PG8/L17-22), wherein the insulating film (10) is configured as a low-hydrogen-content inorganic insulating film having a hydrogen content of less than 10 at% (PG8/L26-27: $\text{Si}_x\text{H}_y\text{N}_z$ and x and z each range from about 1.0 to 1.3 resulting in Si/N is between 0.769 and 1.3, y ranges from about 0.05 to 0.30 resulting in hydrogen content ranging from 1.9% to 15%), and wherein the insulating film (10) is formed so as to adjust the Si/N atomic ratio thereof to 0.8 to 1.8, both ends

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inclusive (PG8/L17-22: $\text{Si}_x\text{H}_y\text{N}_z$ and x and z each range from about 1.0 to 1.3 resulting in Si/N is between 0.769 and 1.3), and wherein the solar cell further comprising a back electrode (14) provided so as to cover the back side of the semiconductor solar cell substrate (see 14 on "rear side" in Fig), Chauduri does not disclose said insulating film also provided on the back side of the substrate. And further the reference does not disclose the back electrode covering the insulating film and contacting the back surface of the semiconductor solar cell substrate through conductive portions penetrating the back-side insulating film.

Münzer discloses a solar cell comprising: a semiconductor solar cell substrate (3), a first major surface light receiving surface front portion (4), a light-receiving-surface-side insulating film composed of silicon nitride (15), a second major surface (6), the backside insulating film composed of silicon nitride (17), an electrode (13, 14: contacting structure) covering the insulating film and contacting the back surface of the semiconductor solar cell substrate through conductive portions penetrating the back-side insulating film (17 in Fig. 1). Further Münzer discloses that both insulating films (15 and 17) also serve to passivate the surface of the substrate [0029].

These references are analogous because both are directed towards silicon solar cells contacting electrodes with silicon nitride inorganic insulating films.

It would have been obvious to one having ordinary skill in the art at the time of the invention to put the insulating film of Münzer on the backside in the device of Chauduri as taught by Münzer in order to passivate the surface of the silicon wafer [0029]. Also, it would have been obvious to one having ordinary skill in the art at the

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time of the invention to have the back electrode cover the insulating film and to contact the semiconductor solar cell substrate through conductive portions penetrating the back side insulating film in the device of Chauduri to allow carrying away of electrical current produced by the solar cell as taught by Münzer [0025].

Regarding limitations recited in claim 8 which are directed to method of making said inorganic insulating film, it is noted that said limitations are not given patentable weight in the product claims. Even though a product-by-process is defined by the process steps by which the product is made, determination of patentability is based on the product itself and does not depend on its method of production. *In re Thorpe*, 777 F.2d 695, 227 USPQ 964 (Fed. Cir. 1985). As the court stated in *Thorpe*, 777 F.2d at 697, 227 USPQ at 966 (The patentability of a product does not depend on its method of production. *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969). If the product in a product-by-process claim is the same or obvious as the product of the prior art, the claim is unpatentable even though the prior art product was made by a different process.). See MPEP 2113 and 2114. *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983).

Regarding claim 3, Chauduri discloses all the claim limitations as set forth above but does not disclose the hydrogen content of the low-hydrogen-content inorganic insulating film is 5 at% or less. Chauduri does disclose the inorganic insulating silicon nitride film having hydrogen content ranging from 1.9% to 15% (PG8/L26-27: $\text{Si}_x\text{H}_y\text{N}_z$ and x and z each range from about 1.0 to 1.3 resulting in Si/N is between 0.769 and 1.3, y ranges from about 0.05 to 0.30).

While modified Chauduri does not explicitly disclose said back side insulating film being configured as a low-hydrogen-content inorganic insulating film having a hydrogen content of less than 10 at%, since the solar cell cost of construction and efficiency are variables that can be modified, among others, by adjusting hydrogen content, with said construction cost and efficiency both increasing as the hydrogen content decreased, the precise hydrogen content would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was made. As such, without showing unexpected results, the claimed hydrogen content cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, hydrogen content in the apparatus of Chauduri to obtain the desired balance between solar cell cost of construction and efficiency (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

Regarding claims 9, 13, 24, and 26, Chauduri discloses a solar cell comprising a semiconductor solar cell substrate (2) having a light receiving surface formed on the first major surface thereof (PG6/L13-14, "front side"), and generating photovoltaic power based on the light irradiated on the light receiving surface (P1/L1-4), having a second major surface (PG6/L17-19, "rear side") of the semiconductor solar cell substrate (2). While Chauduri discloses an insulating film (10) provided as an inorganic insulating film (inherent of SiN films) composed of silicon nitride (P8/L26-27) as an inorganic insulating

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material (inherent of SiN films) having a cationic component (inherent of SiN films) thereof principally comprising silicon (PG8/L17-22), wherein the silicon nitride film (10) is formed so as to adjust the Si/N atomic ratio thereof to 0.80 to 1.80 (PG8/L17-22: $\text{Si}_x\text{H}_y\text{N}_z$ and x and z each range from about 1.0 to 1.3 resulting in Si/N is between 0.769 and 1.3), both ends inclusive, and wherein the solar cell further comprises a back electrode (14) provided so as to cover the back side of the semiconductor solar cell substrate (see 14 on "rear side" in Fig), Chauduri does not disclose said insulating film also provided on the back side of the substrate. And further the reference does not disclose the back electrode covering the insulating film and contacting the back surface of the semiconductor solar cell substrate through conductive portions penetrating the back-side insulating film.

Münzer discloses a solar cell comprising: a semiconductor solar cell substrate (3), a first major surface light receiving surface front portion (4), a light-receiving-surface-side insulating film composed of silicon nitride (15), a second major surface (6), the backside insulating film composed of silicon nitride (17), an electrode (13, 14: contacting structure) covering the insulating film and contacting the back surface of the semiconductor solar cell substrate through conductive portions penetrating the back-side insulating film (17 in Fig. 1). Further Münzer discloses that both insulating films (15 and 17) also serve to passivate the surface of the substrate [0029].

It would have been obvious to one having ordinary skill in the art at the time of the invention to put the insulating film of Münzer on the backside in the device of Chauduri as taught by Münzer in order to passivate the surface of the silicon wafer

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[0029]. Also, it would have been obvious to one having ordinary skill in the art at the time of the invention to have the back electrode cover the insulating film and to contact the semiconductor solar cell substrate through conductive portions penetrating the back side insulating film in the device of Chauduri to allow carrying away of electrical current produced by the solar cell as taught by Münzer [0025].

Regarding limitations recited in claims 9, 13, 24 and 26 which are directed to method of making said inorganic insulating film, it is noted that said limitations are not given patentable weight in the product claims. Even though a product-by-process is defined by the process steps by which the product is made, determination of patentability is based on the product itself and does not depend on its method of production. *In re Thorpe*, 777 F.2d 695, 227 USPQ 964 (Fed. Cir. 1985). As the court stated in *Thorpe*, 777 F.2d at 697, 227 USPQ at 966 (The patentability of a product does not depend on its method of production. *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969). If the product in a product-by-process claim is the same or obvious as the product of the prior art, the claim is unpatentable even though the prior art product was made by a different process.). See MPEP 2113 and 2114. *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983).

Regarding claim 25, modified Chauduri discloses all the claim limitations as set forth above and Münzer further discloses a solar cell wherein

- the semiconductor solar cell substrate is a silicon substrate (3), the inorganic insulating film is a silicon nitride film [0029]

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allison Bourke whose telephone number is (571)270-1232. The examiner can normally be reached on Monday-Thursday 8:30am-5pm and every other Friday 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571) 272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. B./
Examiner, Art Unit 4133

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 4133